Technology Assessment: Ethical and Normative Aspects

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Abstract

The conceptualisation of technology assessment (TA) depends essentially on whether TA is considered as scientific expertise and forecasting, or as a value normative judgement. Over the past fifteen years the focus of attention has gradually moved from cognitive aspects of technology assessment connected with the forecasting of technological development and its effects to axiological issues, problems of ethics and responsibility.

Normative evaluation cannot be a task for experts only—it should be a cause involving a broader group of societal actors. In other words, normative evaluation is essentially a problem of public participation. The normative component of technology assessment actualises the problematic of social responsibility including both its distribution and delegation in the context of TA. This component offers a perspective for technology assessment as a scientifically grounded art of social practice aimed at improving the public control of technological development. But the strict binding of technology assessment to a static norms hierarchy seems at least as ineffective. The orientation of TA to taking into account such societal effects of technological development as metamorphosing and synergism could be considered as being optimal.

The cognition of the world and based on this cognition, a constantly increasing innovative activity are the basic conditions of human existence. Due to the 'generic' ability to both think about and transform the world, humans have achieved unprecedented technological power. But man is at the same time insuperably dependent upon his technology. Dramatic changes brought about by scientific and technological development touch upon all aspects of social and private life. The intensive spread of modern technologies is gradually washing away the former demarcation lines between countries, information sectors, social groups and individuals. Now, at the turn of the millennium, apparent human omnipotence all too often turns into powerlessness in the face of uncontrolled processes in the technogenic world.

Technology and society

Technological development and its consequences can be considered as a process that leads to quantitative and qualitative changes in nature and society. Technology is not regarded as an object as opposed to a subject of technical activity or as the opposite of the natural, but as a medium (Bechmann 2000) or an active environment. People are engulfed in this environment, and are ever more becoming a part of it. The technological environment is not only active, but also aggressive; it absorbs and supersedes the natural environment and thus changes human society.

This point of view presupposes that technology (technosphere) is not an autonomous social subsystem like science, the economy or politics. Technology is a communicative 'seamless web' (Hudges 1986) that perceives impulses from social subsystems or separate social actors. Technology as an active medium is able not only to perceive, but also accumulate and transform these impulses, imparting a new quality of social communication.

The dynamics of technology create illusions of autonomy and an evolutionary character of technological development. It is, however, no more than some sort of deception of vision. Technical artefacts and technologies are only potential functions if considered in abstraction from the social context of their application.

The real functions of artefacts and technologies are determined socially. Technological development is a very important component of the qualitative transformation of reality that includes the natural environment, social structures and, finally, human physiology, behaviour and consciousness.

Cognitive factors play a very important role in the technological transformation of reality. It is impossible to give a full description of this interaction of cognitive factors from a linear or determinist point of view. New technological ideas, innovations etc. are conditioned by previous metamorphoses of reality and, in their turn, stimulate future changes. But the continuous accumulation and interaction of separate technological innovations change our world irrationally, despite the rational character of a separate technological innovation.

What does this mean for societal values? Technical innovation or projects are value motivated, independent from understanding of how engineers, inventors or technical specialists view them. Values are objectified by technological activity. The production of an artefact, development of a technology and their consequent use objectified from values are from this point of view, a contribution to the dynamics—stabilisation or modification—of value systems, i.e. an act of socio-cultural communication. The subsequent existence of artefact or technology interpreted as socio-cultural communication is an art of the interaction with value systems. The modification a technology is bringing to light a course of interaction of new value senses, which stimulate further technological activity (see Boulding 1969).

Technology assessment and its conceptualisation

The reflection on effects of technological development has a long history beginning with ancient mythology. But the idea of forecasting, assessment and rational control of technological development was distinctively formulated in a period between the First and the Second World Wars. For instance, Werner Sombart proposed to assess not only the physical effects of new inventions, but also their impact on societal values (Sombart 1934). Nevertheless practical efforts have only been made from the 1960s against the background of public anxiety of negative economic, social and environmental impacts of technological progress. One result of these efforts was the institutionalisation of technology assessment.

Technology assessment was an attempt at compromise. In contrast to the world dynamics modelling (Forrester 1971; Meadows D.L. *et al.* 1972; Pestel and Mesarovich 1976) or development of global futurological concepts (Toffler 1971; Kahn 1967; Bell 1976), technology assessment (TA) is oriented to a complex interdisciplinary analysis of concrete technologies or projects. Technology assessment cannot pretend to fill a role of an innovation filter or a certain technocratic areopagus like Bacon's 'Solomon's House'. The initial fear that technology assessment will tend to 'technology arrest' was soon refuted by the practice of TA institutions.

Only very minor parts of technological projects have been stopped on the grounds of recommendations of TA experts. Both the concept of technology assessment and its institutional forms are oriented to avoid any suspicion of technocratism. Since the 1970s the majority of experts have adhered to the opinion that technology assessment does not provide any recommendations about what is necessary to do, but submits to decision-makers comprehensive information about what is possible to do (Gibbons 1991). The last word is the prerogative of politicians under this approach, and the experts have at best, a consultative voice.

The conceptualisation of technology assessment depends essentially on whether TA is considered as scientific expertise and forecasting, or as a value normative judgement, or as a synthesis of both of these views. The background of this statement of a question is a contraposition of two points of view:

(1) Technology assessment is scientific research that has its own specificity (interdisciplinary, orientation to the support of policy making processes, necessity of public participation in the assessment etc.);
(2) Technology assessment is a scientifically grounded art of public activity.

This contraposition is finally rooted in Kant's distinction of theoretical and practical reason. The attempt of reconciliation of both points of view is quite admissible; nevertheless it assumes not equilibrium, but primary orientation to one point of view.

The first decade of TA institutional history is characterised by an absolute prevalence of the first view. Value neutrality in Max Weber's sense, an elimination of normative judgements, and description instead of prescription were the basic working principles of the US Office of Technology Assessment (1972–1995)—the pioneer and most authoritative TA institution.

But the focus of attention has gradually moved from cognitive aspects of technology assessment connected with the forecasting of technological development and its effects to axiological issues, problems of ethics and responsibility. In the 1980s questions about the normative basis of technology assessment have been raised in the context of explication of norms and values, which are relevant to technological activity and decision-making. Although the most radical ideas like technoaxiology (Carpenter 1982) or reinterpretation of technology assessment as a new social philosophy (Skolimovski 1982) have found a narrow response, nevertheless an important attempt to define appropriate norms and values for TA took place within the framework of elaboration of the guideline 'Technology Assessment. Concept and Foundations' on behalf of the Association of German Engineers (VDI).

Normative technology assessment

The guideline defines technology assessment as: 'methodical, systematic, organised process of

– analysing a technology and its developmental possibilities;
– assessing the direct and indirect technical, economic, health, ecological, human, social, and other impacts of this technology and possible alternatives;
– judging these impacts according to defined goals and values, or also demanding further desirable developments;
– deriving possibilities for action and design from this and elaborating these;

so that well-founded decisions are possible and can be implemented by suitable institutions if need be' (VDI 1991: 5).

The key feature of the definition consists in the requirement to correlate prospective consequences of technological development with societal norms, purposes and values. There have always been societal judgements of technologies and their effects in public opinion and in the behaviour of social actors. But this is often more explicit in the relevant political decision-making.

Despite of the complexity and interlinkage of different societal judgements of technologies and their effects, the authors of the VDI guideline have put a task to develop the catalogue of values, which could be a guiding vision for technology assessment. A general basis for this work was a goal declared by VDI to secure and improve human living conditions by developing technological means and applying them sensibly (VDI 1991).

The guideline names and comments eight fields of values—so called octagon: functionality, economy, prosperity, health, safety, environmental quality, personality development, and societal quality. The authors of the guideline have stressed that the octagon's values are not equivalent, and these often stand in a competitive relationship with one another. For instance, personality development and societal quality are most important for strategic technological decision making, whereas environmental quality and prosperity play a subordinate or instrumental role here.

No doubt, the octagon embraces basic values of modern Western society. We observe a broad consensus concerning these values if they are considered separately. But due to the pluralism of democratic society, a decision-maker often deals with value preferences. Taking into account synergies and conflicts among different basic as well as subordinate values, the octagon cannot be considered as a stable hierarchy of norms, but rather as a catalogue for arbitrary choice. Furthermore the structure of the catalogue of values is not indisputable: for example, the value of cultural identity is one of such controversial points.

Thus the effectiveness of a normative value system for technology assessment is an open question. Nevertheless the VDI guideline proposes to distinguish the following phases in technology assessment:

- definition and structuring of the problem;
- descriptive impact analysis;
- normative evaluation;
- decision-making.

This distinction may be re-interpreted from the axiological point of view. The first phase should thus include not only the problem definition, presupposed framework conditions, time horizon, assessment criteria etc., but also indication of the value context.

The second phase, i.e. descriptive impact analysis, is necessarily under any TA approach as a scientific component of technology assessment. It could also include the forecasting of value dynamics in connection with technological development. As F. Rapp, one of the authors of the VDI guideline, emphasises it is not inevitable that a long-term oriented decision made on the basis of present-day values will be accepted by future generations (Rapp 1988). Technology assessment should not, therefore, be a single act, but a process which also includes the monitoring of value dynamics.

The most controversial is the third phase of technology assessment, i. e. normative evaluation that is the confrontation of the effects with societal values. In comparison with the second phase, the third phase also implies value preferences of the evaluation subject. In this connection it is especially important to explicate the value basis so that one may compare it to the assessments made by other individuals or institutions. The transparency requirement, however, is topical for all phases of TA.

Regarding the normative evaluation as a phase of TA, we cannot reduce it to the individual choice of a researcher between different norms and values in the sense of R.K. Merton's 'sociological ambivalence' (Merton 1963). Normative evaluation of effects of technological development is the social choice. It cannot be the task only for experts—it should be the cause for broader groups of societal actors. In other words, normative evaluation is essentially a problem of public participation.

In the procedural sense, the normative evaluation should be separated from other phases of TA, because the confusion of analytical phase and value-normative judgements leads to internal undermining of TA and can cause its rejection by decision makers. At the same time the demarcation of the normative evaluation and final decision-making would be also preferable. Otherwise normative-value judgements are left in the competence sphere of a decision-maker, i.e. a technocratic way of technology-oriented decision-making.

Of course, the distinction of phases of technology assessment, as proposed by the VDI guideline, is not comprehensive. The approach of constructive technology assessment, for example, is quite different from the scheme outlined above. Nevertheless the normative component of technology assessment actualises the problematic of social responsibility including both its distribution and delegation in the context of TA. This component offers a perspective for technology assessment as a scientifically grounded art of social practice aimed at improving the public control of technological development. But the strict binding of technology assessment to a static norms hierarchy would appear to be at least as ineffective. The orientation of TA to taking into account such societal effects of technological development as metamorphosing and synergism might be considered as an optimal way.

Within the framework of complex socio-technical systems we deal with untraditional strategies of decision-making that include a new type of integration of truth and morality, purposefulness and value-rational action (see Styopin 2000). Under these conditions, scientific cognition and technological activity must take into account the whole spectrum of possible trajectories of system development in bifurcation points (see Prigogine and Stengers 1984). An impact on the system aimed at knowledge or technological change deals with the problem of choice of the optimal development scenario from numerous possible scenarios. This choice should be based not only on the scientific information or cost-benefit calculation, but also on the understanding of broad responsibility of a decision-maker as well as imposing a ban on some kinds of impact on the system. Therefore a technical action should be assessed first of all not from the point of view of the purpose achievement or the objectivation of appropriate values through the action, but in the sense of its probable consequences that result in societal changes. As a matter of fact, this is a manifestation of fundamental difference between the ethics of conviction (Gesinnungsethik) and ethics of responsibility (Verantwortungsethik). The latter means that the foreseen consequences are considered as being charged to action and its subject.

Thus the main criterion of the normative technology assessment should be not hierarchically organised value systems of any kind, but the fundamental imperative of action based on the 'generic' value of human life, the existence of present-day and future generations. This imperative of broadened responsibility is a basis for preliminary normative assessment. An appeal to value hierarchy and its ad hoc interpretation should follow this preliminary assessment.

Technology assessment and ethics of responsibility

The ethical problematic of technology assessment is very wide ranging. First of all there are numerous value conflicts in such cases of moral choice as intervention into the mechanisms of heredity, genetically modified food, transplantation of organs, unsanctioned access to confidential or private information etc. Secondly, technological action has its own ethical dimension within the framework of specialised engineering ethics. Third, technology assessment as scientific support of technology oriented decision-making exceeds the bounds of the individual ethics of responsibility and actualises the institutional and social levels of responsibility. Finally, debates on the future oriented, precautionary and broadened responsibility find also their reflection in technology assessment.

The etymology of the word ‘responsibility’ has its origins in a communicative act. To be responsible means to answer for one’s action or behaviour, to be able to justify them before one’s own conscience and reason as well as other people including future generations. In general outline, the responsibility may be characterised as a moral interpretation of social communication.

The idea of broadened precautionary responsibility for future generations and the environment has been formulated as a reaction to the existential threat resulting from uncontrolled technological development. This idea means transition from ex post responsibility, or responsibility of guilty person, to ex ante or responsibility of stewardship (see Jonas 1979). The idea brings to light of ethical discourse long-term, cumulative and unanticipated consequences of technological activity. In particular, it demonstrates the insufficiency of both individual moral responsibility and corporative engineering ethics in the face of such effects.

Both knowledge and power are measures of responsibility. The broadened precautionary responsibility actualises the problem of forecasting and assessment of the long-term effects of technological development. But an individual prognostic ability of the scientist, designer or engineer is often insufficient. For example, the revolution in new materials has launched mankind into an era when anything can be manmade, with an infinite variety of functions and combinations. At the same time it creates a situation of 'hyperchoice' (Salomon 1998). In other words, the power of the scientist, designer and engineer increases, whereas their knowledge concerning long-term societal effects—in comparison with their power—decreases.

In addition, synergetic and cumulative effects in complex socio-technical systems often result in power and knowledge losing their adequacy as measures of responsibility. Knowledge is a doubtful and probabilistic quantity under such conditions and taking possession of more information does not confirm the assumption of greater responsibility. In regard to technological power, the scale of consequences here does not exactly correspond with the measure of power. An action, which can be characterised as minor and insignificant under normal linear interaction, can result in greater effects under synergetic interaction in bifurcation areas.

Nevertheless the difficulties mentioned above do not mean that the ethics of responsibility should be excluded from the discussion on technological development and its societal effects. First of all, many effects can be anticipated by means of the widely applicable methods of analysis and forecasting. Some more effects can be discovered by means of introducing new methods or sufficiently improving existing methods. So far as difficulty of the anticipation of consequences is a cognitive problem of technology assessment, there is a space for moral reflection on the foreseen effects of technological development including discussion of the issues of responsibility.

The comparability of cognitive and ethical spaces of technology assessment means that the sphere of responsibility in TA covers not only foreseen effects, or knowledge areas in the cognitive space of TA, but also effects that are unforeseen by means of traditional prognostic methods. The latter is an area of uncertain knowledge in the cognitive space of technology assessment. Since technology assessment can contribute to the moral justification for some actions, experts involved in TA must draw the boundary defining the area of uncertain knowledge.

It is evident that some kinds of ignorance do not exclude responsibility (Zimmerli 1991). Responsibility in modern technological activity can be interpreted as specific 'management of ignorance' which goes beyond the traditional understanding of responsibility for action and its anticipated effects. One of the tasks of technology assessment should be the development of additional mechanisms for such 'ignorance management'. No doubt, this is a task not only for experts, but also for citizens, stakeholders and interest groups.

Technology assessment and especially its participatory approach can be considered as a specific model of both distribution and delegation of responsibility for the long-term effects of technological activity. In the first place the institutionalisation of TA itself means the delegation of a part—but only a part—of social responsibility to the specialised institution.

Furthermore, TA as an independent expertise overcomes the contradiction between role responsibility (for example, the responsibility of the designer for the quality of a technological project) and precautionary broadened responsibility. This is the very case where TA could serve as a normative and ethical evaluation, and give special recommendations, if necessary, concerning responsibility for the subjects of technological activity. In this way TA can compensate for a deficiency of ethical substantiation typical for design processes. The shortcoming of this understanding of technology assessment is that the matter of TA comprises in the main the consequences and effects of projects that have already been implemented or projects that are in the course of realisation.

In technology assessment, public participation has the objective of finding a consensus, of bringing about social learning and improving the information base of the decision-maker by clarification of existing opinions. Participatory technology assessment as a forum for public discussion, conflict resolution and the search for consensus among social actors gives an opportunity to realise individual or group responsibility. This means that TA promotes an increase in the social significance of ethics. Finally, interactive and interdisciplinary technology assessment may contribute both to the development of specialised kinds of ethics, such as nuclear ethics or bioethics, and at the same time to a compensation of the excessive differentiation and specialisation of ethics.

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